9. The powder coating composition of Claim 8 wherein terephthalic acid and isophthalic acid are used in a molar ratio of terephthalic acid to isophthalic acid of about 100/0 to 0/100.

10. The powder coating composition of Claim 9 wherein the molar ratio of terephthalic acid to isophthalic acid is about 80/20.

Cancel Claim 11.

12. The powder coating composition of Claim 1 further comprising conventional auxiliary agents and additives.

13. The powder coating composition of Claim 1 wherein the ratio of epoxy to carboxyl is in the range of 0.5/1 to 6/1.

14. A polyester powder coating composition which comprises:

a) a polyester resin characterized by a acid value of 10 to 100 mg KOH/g formed by reacting a mixture of aliphatic glycols comprising 15-50% on a molar basis 1,3-propanediol and the balance neopentyl glycol with a mixture of terephthalic acid and isophthalic acid, wherein the ratio of terephthalic acid to isophthalic acid is in the molar range of 100/0 to 0/100; and

a triglycidyl isocyanurate.

15. Any coated product made using the powder coating of Claim 1.

Remarks

Table 8 has been changed to correct the mistake that was made in the Preliminary Amendment. Table 8 has been amended to correct the designation of the second column from the left from T-30 to T-15 and the designation of the last column from PT-15 to PT-30. It is clear by reference to Figure 4 that these changes are correct now and are supported by the specification as filed. T-15 has the impact resistance of 100 at the highest film thickness in Figure 4 and this matches the data in the second column from the left. The last column, PT-30, now matches Table 8 as originally filed. The Applicants believe that this change overcomes the new matter rejection.

The Examiner rejected all of the claims under 35 U.S.C. 112, second paragraph, as being indefinite. There were several reasons for this and the Applicants assert that the above amendments have addressed all of these reasons. The basis for the amendments to better explain the aliphatic glycols which are used and the amounts thereof are found in the specification in the Summary of the Invention and in the first part of the Detailed Description of the Invention on pages 3 and 4. Also, the Examples serve as basis for these amendments since the Examples make it clear that a mixture of aliphatic glycols is used to make the polyester resin and that the mixture of aliphatic glycols must contain a specified amount of 1,3-propane diol (see for example Table 3 on page 11). The above amendments clean up the Markush group objections made by the Examiner and also correct a number of minor wording issues, i.e., the specification of "acid" in several of the claims. Claim 11 has been canceled.

Claims 1 through 9 and 11 through 15 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Merck (U.S. 4,740,580). The Examiner states that the reference teaches powder coating compositions comprising a polyester made from terephthalic acid and neopentyl glycol with another aliphatic diol and glycidyl isocyanurate. Both neopentyl glycol and 1,3-propane diol are mentioned in the list of other aliphatic diols. Claims 1 through 3 and 5 through 15 have been rejected under Section 35 U.S.C. 103(a) as being unpatentable over Marsiat (U.S. 4,085,159). The Examiner characterizes this reference as teaching powder coated compositions comprising a polyester made from terephthalic acid and isophthalic acid with neopentyl glycol and another aliphatic glycol and glycidyl isocyanurate, wherein 1,3-propane diol is mentioned as one of the other aliphatic glycols. The Examiner's rejections are respectfully traversed.

The cited references both demonstrate the use of ethylene glycol as a modifier for carboxyl terminated polyester resins used in powder coatings cured with triglycidyl isocyanurate (TGIC). Both patents list 1,3-propanediol (PDO) in the specification as an alternative modifier for the carboxyl polyester resin. The comparison of the materials made in these two patents with the materials demonstrated in the present application is difficult because of the large number of differences in the compositions shown in the Examples. For that reason, the Applicants have included the attached two tables which contain summary descriptions of the Examples of the two references.

The resins produced in Merck are higher in molecular weight, have less branching, and have less filler than the resins produced according to the present invention. All of these differences would be expected to result in a resin that has significantly more flexibility than the resins of the present invention. In addition, the examples in Merck all utilize adipic acid in the

resins (except Comparative Example 1). It is well known that adipic acid is a flexibilizer for these systems but that it also affects other properties such as scratch resistance and hardness. When comparing the impact test data that is available in the patent and in the present application in Table 8 on page 16 (as modified by this amendment), it is clear that the materials of the present invention have substantially more flexibility as measured by impact resistance than the materials made according to the disclosure of Merck. The impact resistances of the examples of Merck range from 35 to 70 in-lbs whereas the impact resistances of the formulations made according to the present invention (T-15, T-30, and T-50) are much higher at equivalent film thicknesses (60 micrometers = 0.060 millimeters), i.e., 160 in-lbs.

The systems of the present invention and the patent are very different but the differences would tend to lead one of ordinary skill in the art to believe that the materials of Merck would be more flexible than the materials of the present invention. The extent of the flexibility improvement is surprising since PDO is a simple analog of ethylene glycol. It is clear that the use of PDO as one of the glycols to make the polyester resin provides these improved results. Furthermore, while the flexibility is dramatically increased, there is very little effect on other properties of the cured powder coating.

In comparing the present invention with the examples of Marsiat, it can be seen that the equivalent weight is slightly lower, the branching is a little higher, and the filler concentration is much lower for the resins in the examples of the reference. The effect of these differences is branching and molecular weight would be expected to reduce the flexibility of some of the resins of the reference in comparison to the resins of the present invention but the lower filler content of the references resins would be expected to improve flexibility. The net result of these counter effects is hard to judge but it would be anticipated that the filler effect would be larger since there is a much larger change for that than for the equivalent weight and the branching changes. In addition, the pertinent examples in Marsiat also contain 7.8 mole percent of 1,6-hexane diol. This is well known to be a modifier for increased flexibility. It is also well known that the use of this modifier affects many other properties including scratch resistance and hardness. Examples 1 and 2 of Marsiat contain an epoxy resin and are thus different from the compositions of this invention.

When the impact resistance results shown in Table 8 of the present application are compared with the results of the examples of the reference, it can be seen that there is a very large difference, i.e., 160 in-lbs as opposed to 26 to 70 in-lbs. The size of this difference is surprisingly large. One would not anticipate this difference when merely changing the modifier from ethylene glycol to PDO because they have such similar structures.

In the office action, the Examiner stated that "absent a showing of criticality commensurate in scope with the claims, the claims are unpatentable over the reference." The Applicants assert that the data shown in Table 8 of the present application proves that there is a nonobvious difference in results by following the present invention and using PDO as opposed to following the disclosures of the cited references. The Applicants assert that the obviousness rejections have been overcome and respectfully request an early notice of allowance.

Respectfully submitted,

SHELBY F. THAMES, OLIVER W. SMITH,
LICHANG ZHOU, WYNDHAM H. BOON,
THOMAS C. FORSCHNER, and
DAVID E. GWYN

By _____
Their Attorney, Donald F. Haas
Registration No. 26,177
(713) 241-3356

P.O. Box 2463
Houston, Texas 77252-2463

APPENDIX

In the Specification:

Please replace the version of Table 8 which replaced the originally filed Table 8 (page 16) by the Preliminary Amendment of October 16, 2001 with the following new table:

Table 8. Front/Reverse Impact Resistance of Polyester/TGIC Powder Coatings

Film Thickness (mil) (mm)	T-00 (in.lb.) (N-m)	T-[30]15 (in.lb.) (N-m)	T-30 (in.lb.) (N-m)	T-50 (in.lb.) (N-m)	PT-00 (in.lb.) (N-m)	PT-[15]30 (in.lb.) (N-m)
1.4-1.6 (0.036-0.041)	----	----	----	----	130/130 (14.7/14.7)	160/160 (18.1/18.1)
1.8-2.0 (0.046-0.051)	160/160 (18.1/18.1)	160/160 (18.1/18.1)	160/160 (18.1/18.10	160/160 (18.1/18.1)	----	----
1.9-2.2 (0.048-0.056)	----	----	----	----	100/90 (11.3/10.7)	160/160 (18.1/18.1)
2.2-2.4 (0.056-0.061)	140/140 (15.8/15.8)	160/160 (18.1/18.1)	160/160 (18.1/18.1)	160/160 (18.1/18.1)	----	----
2.4-2.6 (0.061-0.066)	----	----	----	----	80/60 (9.0/6.7)	160/160 (18.1/18.1)
2.6-2.9 (0.066-0.074)	110/100 (12.4/11.3)	160/160 (18.1/18.1)	160/160 (18.1/18.1)	160/160 (18.1/18.1)	----	----
3.3-3.5 (0.084-0.089)	60/30 (6.7/3.4)	100/80 (11.3/9.0)	130/130 (14.7/14.7)	160/160 (18.1/18.1)	----	----

In the claims:

1. A polyester powder coating composition [having as the essential elements] which comprises:

a) from 85 to 96 wt% of a polyester resin formed by reacting [an] a mixture of aliphatic [glycol] glycols and one or more dicarboxylic acids, wherein the mixture of aliphatic [glycol] glycols [is] comprises from 5 to 90% on a molar basis 1,3-propanediol;

from 4 to 15 wt% of a triglycidyl isocyanurate crosslinking agent; and

optionally conventional catalysts, auxiliary agents, and additives.

2. The powder coating composition of Claim 1 wherein the aliphatic glycol in the mixture of aliphatic glycols which is not 1,3-propanediol is selected from the group consisting of 1,3-butylene glycol, 1,4-butylene glycol, ethylene glycol, propylene glycol, 2-methyl-1,3-propanediol, 1,6-hexanediol, and neopentyl glycol.

3. The powder coating composition of Claim 2 wherein the aliphatic glycol in the mixture of aliphatic glycols which is not 1,3-propanediol is neopentyl glycol.

5. The powder coating composition of Claim [1] 3 wherein the [polyester resin comprises: a) neopentyl glycol substituted with] mixture of aliphatic glycols comprises from 15 to 50% on a molar basis 1,3-propanediol[; and b) one or more dicarboxylic acids].

6. The powder coating composition of Claim 1 wherein the dicarboxylic acids are selected from the group consisting of saturated, unsaturated, aliphatic, [or] and aromatic dicarboxylic acids.

7. The powder coating composition of Claim 6 wherein the dicarboxylic acids are selected from the group consisting of phthalic, isophthalic, terephthalic, naphthalenedicarboxylic, sebacic, maleic, fumaric, succinic, adipic, azelaic, malonic acids, [or] and mixtures thereof.

8. The powder coating composition of Claim 7 wherein the dicarboxylic acids are selected from the group consisting of isophthalic acid, [and] terephthalic acid, [separately or] and a mixture thereof.

9. The powder coating composition of Claim 8 wherein terephthalic acid and isophthalic acid are used in a molar ratio of terephthalic acid to isophthalic acid of about 100/0 to 0/100.

10. The powder coating composition of Claim 9 wherein the molar ratio of terephthalic acid to isophthalic acid is about 80/20.

Cancel Claim 11.

12. The powder coating composition of Claim 1 further comprising [the optional addition of] conventional auxiliary agents and additives.

13. The powder coating composition of Claim 1 [further comprising] wherein the ratio of epoxy to carboxyl is in the range of 0.5/1 to 6/1.

14. A polyester powder coating composition [having as the essential elements] which comprises:

a) a polyester resin characterized by a acid value of 10 to 100 mg KOH/g formed by reacting a mixture of aliphatic glycols comprising 15-50% on a molar basis 1,3-propanediol and the balance neopentyl glycol with a mixture of terephthalic acid and isophthalic acid, wherein the ratio of terephthalic acid to isophthalic acid is in the molar range of 100/0 to 0/100[, and wherein 15-50% on a molar basis of the neopentyl glycol is substituted with 1,3-propanediol]; and

b) a triglycidyl isocyanurate.

UCB Patent US 4,740,580

12/18/2002

Example	1	2	3	4	5
Polyester					
Neopentyl glycol, mol % of glycols	92.0	91.9	91.9	91.9	91.9
Ethylene glycol, mol % of glycols	8.0	8.1	8.1	8.1	8.1
Total Diacids/Trimethylolpropane	NA	NA	62	NA	82
Terephthalic Acid, mol % of diacids	100	94.5	89.1	89.1	78.2
Adipic Acid, mol % of diacids	NA	5.5	10.9	10.9	9.6
Isophthalic Acid, mol % of diacids	NA	NA	NA	NA	12.3
Total Diacids/Trimellitic anhydride	NA	NA	NA	61	NA
Hydroxyl #, mg KOH/g polymer	3.8	1.3	2.6	2.2	4
Carboxyl #, mg KOH/g polymer	22	19	24	23	22
Functionality	2	2	2.5	2.5	2.5
Molecular Weight	4350	5530	5270	5570	5400
Compound					
Polyester (parts by weight)	100	100	100	100	
TGIC	4.2	4.2	4.2	4.2	
TiO2	5.2	5.2	5.2	5.2	
BaSO4	25.9	25.9	25.9	25.9	
FeO	20.8	20.8	20.8	20.8	
Modaflow	1.1	1.1	1.1	1.1	
Cured Film Properties					
Impact, kg-cm (in-lbs)					
Direct	40 (35)	80 (70)	80 (70)	80 (70)	
Reverse	40 (35)	40 (35)	80 (70)	80 (70)	
Film Thickness, microns (micrometers; 0.001mm)	60	60	60	60	

UCB Patent US 4,085,159

12/18/2002

Example	1	2	3	4	5	6
Polyester						
Neopentyl glycol, mol % of glycols	80.5	80.7	71.2	71.2	71.2	71.2
Ethylene glycol, mol % of glycols	19.5	19.3	21.0	21.0	21.0	21.0
1,6-hexanediol, mol % of glycols			7.8	7.8	7.8	7.8
Dimethyl Terephthalate, mol % of diacids	65.8	65.8				
Terephthalatic Acid, mol % of diacids			80.1	78.4	78.4	78.4
Tetrahydrophthalic anhydride, mol % of Diacids	34.2	34.2				
Hexahydrophthalic anhydride, mol % of Diacids			19.9	21.6		
Isophthalic Acid, mol % of diacids					21.6	21.6
Total Diacids/Trimellitic anhydride	5.8	5.8	11.3	11.6	11.6	11.6
Carboxyl #, mg KOH/g polymer	71.0	60.0	49.0	51.0	55.0	50.0
Carboxyl Equivalent wt	790.0	940.0	1145.0	1100.0	1020.0	1120.0
Equivalent Weight	790	940	1145	1100	1020	1120
DP/Equivalent Wt			5.0	4.8	4.5	4.9
Equiv/Trimellitic anhydride			2.2	2.4	2.6	2.3
Functionality			3.4	3.2	3.2	3.3
Compound						
Polyester (parts by weight)	100.0	100.0	100.0	100.0	100.0	100.0
TGIC	11.7	11.7	11.0	11.0	11.0	11.0
TiO2	51.7	51.7	11.2	11.2	11.2	11.2
Epikote 1004	5.0	5.0				
Modaflow	1.5	1.5	1.0	1.0	1.0	1.0
Dyestuff	0.005	0.005	0.007	0.007	0.007	0.007
Cured Film Properties						
Impact, kg-cm (in-lbs)						
Reverse	0.0	30 (26)	60 (52)	80 (70)	60 (52)	80 (70)
Film Thickness, microns	95.0	95.0	60.0	60.0	60.0	60.0